

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

WRITTEN OPINION (PCT Rule 66)

To:

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REPLY DUE within 2 month(s) and 15 days
from the above date of mailing

International application No.
PCT/CA 03/00926

International filing date (day/month/year)
18.06.2003

Priority date (day/month/year)
10.07.2002

International Patent Classification (IPC) or both national classification and IPC
F16C39/06

Applicant
TURBOCOR INC. et al.

1. This written opinion is the **first** drawn up by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
 - I ☒ Basis of the opinion
 - II ☐ Priority
 - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV ☐ Lack of unity of invention
 - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain documents cited
 - VII ☐ Certain defects in the international application
 - VIII ☐ Certain observations on the international application
3. The applicant is hereby **invited to reply** to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also: For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 10.11.2004

Name and mailing address of the international preliminary examining authority:



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I. Basis of the opinion

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed"*):

Description, Pages

1-11 as originally filed

Claims, Numbers

1-33 as originally filed

Drawings, Sheets

1/1 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

6. Additional observations, if necessary:

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	1-7, 10-12, 15-27, 30, 33
Inventive step (IS)	Claims	8,9,13,14,28,29,31,32
Industrial applicability (IA)	Claims	

2. Citations and explanations**see separate sheet**

Independent claims 1 and 20

1. The present application does not satisfy the criterion set forth in Article 33(2) PCT because the subject-matter of claims 1 and 20 is not new in respect of prior art as defined in the regulations (Rule 64(1)-(3) PCT).
2. Before discussing novelty, it is noted that the application does not meet the requirements of Article 6 PCT because claims 1 and 20 are not clear and not supported by the description.
 - a) Claims 1 and 20 require that the **first** gap is "**on the rotation axis**". In all examples, however, the magnet and thus the **second** gap is provided on the rotation axis. The first gap is **not** located on the rotation axis. Claim 1 is not supported by the description.
 - b) Claims 1 and 20 require that the second gap is provided between the magnet and the rotor, ie. the magnet is fixed to the stator. However in the embodiment depicted in figure 2 the sole magnet is provided on the rotor (cf. also claim 4). Accordingly the embodiment of figure 2 does not fall within the scope of claims 1 and 20. Further claims 1 and 4 respectively claims 20 and 24 contradict each other.
 - c) Claims 10 and 21 are not clear, the use of non-magnetic material for the rotor and stator only makes sense when there are provided magnets both on the stator and rotor as depicted in figures 3 and 4. Furthermore, the selection of non-magnetic material in claims 10 and 21 contradicts the subject-matter of claims 1 and 20 which require that the flux path is closed via the first gap (see e.g. figure 1). A non-magnetic material would namely not guide the flux across the first gap as a soft magnetic material would do.
3. It is clear from the above that the scope of claim 1 is not clear because doubt is cast on three technical features thereof. Taking the above in account, each of the following documents are considered to deprive the subject-matter of claim 1 respectively claim 20 of its novelty.
4. Document US 4 167 295 (**D1**) discloses (cf. column 3, lines 38 to 56 and figure 2) a thrust load enhancement device for a rotor-bearing system as defined in claim 1, ie. comprising:
 - a stator (84) mounted on a rotation axis of the rotor-bearing system
 - a rotor (60) separated from said stator by a first air gap (between walls 80 and 90; and

- a permanent magnet (92) fixed to said stator (60) and separated from said rotor by a second air gap,
whereby a flux in said first and second air gaps generates a compensation force between said rotor and said stator that opposes a gas pressure of the turbomachine.
- 6. Document US 6 191 515 A (**D2**) discloses a device in accordance with claim 1 whereby the permanent magnet is mounted on the rotor.
- 7. Document GB 2 335 242 A (**D3**) discloses a device in accordance with claim 1 (cf. in particular figure 2) whereby magnets are fixed both to the stator and the rotor. These magnets are either arranged repulsing (cf. figures 1 to 3) or attracting (cf. figures 4 to 6).
- 8. Another example of two attracting permanent magnets can be found in document DE 195 00 935 A (**D4**)
- 9. Documents GB 1 163 632 A (**D5**) and WO 98 31 947 A (**D6**) discloses another example of mutually repulsive magnets.
- 5. Document EP 0 266 991 A (**D7**) discloses a further example of a device in accordance with claim 1 whereby a permanent magnet (9) is fixed to the stator.

Dependent claims 2 to 19 and 21 to 33

- 10. Dependent claims 2 to 19 and 21 to 33 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, are new or involve an inventive step for the following reasons:
 - For the additional features of claims 2 to 7 and 23 to 27 reference is made to the above points 4 to 9.
 - The provision of a spacer to adjust the height of gap (cf. claims 8 and 28) is known from document US 5 710 470 A (**D8**).
 - The provision of a piezoelectric actuator to adjust the height of a magnet bearing gap (cf. claims 9 and 29) is known from US 5 360 470 A (**D9**).
 - The additional features of claims 10, 11, 21 and 22 are known from each of documents **D1** to **D5**.
 - The features of claims 12, 16, 17, 18 and 30 relate to the use of the device, but do not further characterise the device itself. Furthermore, also in

documents **D1** to **D7** the permanent magnets serve either to counteract the weight, ie. a static load, of the rotor or an external (dynamic) load acting on the rotor (e.g. document **D1**).

- The use of a force sensor, in particular a piezoelectric unit (cf. claims 13, 14, 31 and 32), to control a magnetic bearing is known from US 5 291 975 A (**D10**).
- The additional features of claim 15 are known from documents **D1** to **D8**.
- A vertical configuration (cf. claims 2, 16, 17 and 18) is known from documents **D2**, **D5** and **D7**.
- The combination (cf. claims 19 and 33) with a further magnetic bearing system is known from documents **D2** and **D3**.
- The combination with a hydrodynamic bearing system is known from document **D1**.
- The combination with rolling element bearing system is known from documents **D4**, **D6** and **D7**.

Further prosecution:

11. It is at present not apparent which part of the application could serve as a basis for a new claim which would satisfy the criteria set forth in Article 33(1) PCT. The applicant is invited to respond to the objections stated above.